Modern Biology
Chapter 47 Notes
The Body’s Defense Systems

Section 1:

I. Nonspecific Defenses
   A. Identifying Pathogens
      a. **pathogen** - any agent that causes disease
      b. Robert Koch (1870) studied anthrax that led to “rules” for determining the cause of a disease. These are called:
      C. Koch’s Postulates:

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<td>*The pathogen must be present in an animal that has the disease and absent in healthy animals.</td>
<td>*The pathogen must be isolated from the sick animal and grown in a laboratory.</td>
<td>*When the isolated pathogen is injected into the healthy animal, the animal must develop the disease.</td>
<td>*The pathogen should be taken from the second animal and grown in the lab.</td>
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* The pathogen cultured from the 2nd animal should be the same as the pathogen from the 1st animal.

d. Pathogens can be spread by 5 main ways:
   1. air
   2. food
   3. water
   4. person-to-person contact
   5. animal bites
B. First Line of Defense: Barriers
   1. nonspecific defenses include
      a. skin—serves as a physical barrier
         1. a break in the skin can allow pathogens to enter
         2. sweat, oils, and waxes released by the body have chemicals that are toxic to some pathogens
      b. mucous membranes—which are skin tissues that protect the interior surfaces of the body from pathogens
         1. secrete mucus
         2. mucous membranes line the
            a. respiratory track
            b. digestive system
            c. urethra
            d. vagina

C. Second Line of Defense: Nonspecific Immunity
   1. inflammatory response
      a. a series of events that suppress infection and speed recovery

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<td>An injury may allow pathogens to get past the barrier of the skin. Injured cells release chemical messengers, such as histamine.</td>
<td>Nearby capillaries respond by swelling and leaking fluid. Phagocytes pass through capillary walls and attack the pathogens.</td>
<td>Phagocytes destroy the pathogens, and the injury begins to heal.</td>
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b. **Histamine**—is a substance that increases blood flow to the injured area.
   * it also increases the permeability of surrounding capillaries.

c. **Phagocytes**—ingest and destroy pathogens and foreign material.
2. Temperature Response
   a. Fever- is an increase in the body’s temperature above the normal. (98.6°F)
   b. a moderate temp may slow the growth of bacteria and viruses by giving enough time for the body to produce white blood cells
   c. fevers higher than a few degrees may actually damage proteins and be dangerous and fatal above 105°F.

3. Proteins
   a. can provide a nonspecific response
   b. complement proteins become active when the encounter pathogens
      1. they puncture the membrane of infected cells causing cell death
   c. interferon- helps in viral infections
Section 2:

**immune system** - the cells and tissues that recognize and attack foreign substances in the body

**lymphocytes** - white blood cells of the immune system

**thymus** - a gland that produces a special type of lymphocyte

**spleen** - organ that stores healthy blood cells, breaks down old RBC and helps develop WBC

**B-cell** - a lymphocyte made and complete their development in the bone marrow

**T-cell** - a lymphocyte made in the bone marrow but complete their development in the thymus

**antigen** - any substance that the immune system can recognize and react with

**cell mediated immune response** - an immune response that functions to defend cells against pathogens --- uses T-cells

**humoral immune response** - involves the action of B-cells

**antibody** - binds to a specific antigen or destroys toxins

**immunity** - the ability to resist an infectious disease

**vaccination** - introducing antigens into the body to cause immunity

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I. Specific Defenses: The Immune System
A. The Immune System
1. cells and tissues that recognize and attack foreign substances
2. fights pathogens to stop the growth and spread of cancers
3. Tissues include
   - bone marrow
   - thymus
   - tonsils
   - lymph nodes
   - spleen
   - adenoids
4. White Blood Cells (WBC)
   lymphocytes
B. Recognizing Pathogens
1. lymphocytes recognize foreign invaders
2. antigens cause lymphocytes to react
3. Types of antigens
   - whole or parts of pathogens
   - bacterial toxins
   - insect venom
   - pollen
C. Immune Response
1. an immune response is a 2 part defense on a pathogen that occurs at the same time
   Part 1: cell-mediated immune response which is an immune response that functions to defend cells against pathogens
   Part 2: humoral immune response which is an immune response that involves the B-cells
D. Immunity and Vaccination
1. Immunity is the ability to resist an infectious disease
   a. one way to acquire immunity is to have a vaccination
2. Vaccines contain dead or weakened pathogens or material from a pathogen

Section 3:
**AIDS** (acquired immunodeficiency syndrome) a disease in which the immune system loses its ability to fight off pathogens

**HIV** (human immunodeficiency virus) the virus that causes AIDS

**Opportunistic infection**- an illness caused by pathogens that produces diseases in people with weakened immune systems

I. The course of HIV infection

   Phase I- the asymptomatic phase
   a. no symptoms—so a person would not feel sick at all
   b. virus replicates
   c. takes several weeks for anti-HIV antibodies to become large enough in number to have a positive HIV test
   d. can infect other people during this phase, too
   e. can last for 10 or more years

   Phase II- the beginning of or worsening of symptoms
   a. lymph glands become swollen
   b. fatigue
   c. weight loss
   d. fever
   e. diarrhea
   f. mental changes; forgetfulness, abnormal thinking patterns
   **T-cell levels begin to drop**

   Phase III- AIDS is diagnosed
   a. HIV levels increase dramatically
   b. T-cell levels drop very low
   c. opportunistic infections develop
   d. after AIDS diagnosis—about a 2 year survival rate
   e. usually die from opportunistic infections or cancers
II. Transmission of HIV
   A. the transfer of bodily fluids containing HIV or HIV-infected cells
      1. sexual contact
      2. sharing needles or syringes
      3. infected mothers can transmit HIV to her infant before or during childbirth or during breastfeeding
      4. blood transfusion—very low now with testing
   B. NOT TRANSMITTED BY
      1. casual contact
      2. shaking hands
      3. water
      4. air
      5. toilet seat
      6. insect bites

III. Vaccines and Treatments
   1. trying to create a vaccine but it mutates and evolves very rapidly
   2. HIV becomes resistant to drugs quickly
   3. doctors treat patients with combination of 3 drugs
   4. therapy can require patients to take up to 50 or more pills a day
   5. LOW RISK LIFESTYLES ARE THE BEST PREVENTION